



LAWRENCE BERKELEY NATIONAL LABORATORY

ADVENTURES IN SCIENCE



with Berkeley Lab's Science Explorers

OPEN HOUSE • 2012

**OCTOBER 13, 2012
BERKELEY LAB'S
OPEN HOUSE**



**Berkeley Lab Director
Paul Alivisatos**

Welcome to Berkeley Lab's Open House. If you have questions about the world around you and you love to solve puzzles and figure things out, then you have the heart of a scientist, and you are very much like the people who work here at Berkeley Lab. We ask questions, figure out possible solutions, and test our ideas in order to solve problems — from how to save energy to how the universe began; from building the smallest machines to building large scientific tools; from breaking down plants to make fuel to breaking open the genetic code to cure cancer — we at Berkeley Lab welcome you today to join us in discovering the secrets of our world and how to meet some of the biggest challenges that humans have ever faced. We encourage you to ask questions and look for answers — today and every day!

Section: 1

BUS STOP – ADVANCED LIGHT SOURCE TOUR

TICKETS REQUIRED

Pick up in Section: 2

See below for more information

Section: 2

WELCOME BOOTH

Berkeley Lab staff will be on hand to let you know about everything happening at Open House. This is also where kids can pick up their passport and return it for a prize after filling it out.

ADVANCED LIGHT SOURCE TOURS

Come to the Advanced Light Source (ALS) and learn how our researchers use brilliant x-rays to “explore” the inner world of atoms and molecules. Tour the experiment area where scientists have built a seemingly impenetrable jungle of pipes and cables to maneuver beams of light onto materials as diverse as protein crystals and flames. Under illumination these materials reveal fundamental properties that help point the way to more efficient energy sources, more effective drugs, faster computer chips, and more. Scientists and staff will be on hand to answer questions about their research and demonstrate how light is used in experiments. Join the informal Café Scientifique on the patio and hear about current work at the ALS while enjoying a light snack.

TICKETS REQUIRED

QUANTITIES LIMITED — FIRST-COME, FIRST-SERVED

Board Shuttle Bus in Section: 1 to reach facility

Session One — Boards after 10 a.m.

Session Two — Boards after 11 a.m.

Session Three — Boards after noon

Session Four — Boards after 1 p.m.

LAB BUS TOURS

Explore the Lab by taking a 15-minute bus ride around the campus to learn more about the research that takes place here. The tour also includes spectacular views of the Bay.

TICKETS REQUIRED

Bus stop located in Section: 10



See map on back cover

88" CYCLOTRON TOURS

Explore the 88-Inch Cyclotron to learn how new elements are discovered and studied. Visit the 88's Berkeley Accelerator Space Effects (BASE) Facility, where electronic parts are tested for satellites and space probes. Professor Ernest Orlando Lawrence, founder of this laboratory, invented the cyclotron in 1931 and was awarded the 1939 Nobel Prize in Physics for his invention.

TICKETS REQUIRED
QUANTITIES LIMITED

U.S. DEPARTMENT OF ENERGY OFFICE OF SCIENCE

Learn more about the 10 national labs the Office of Science stewards, and the research support they provide for over 300 universities and institutions.

EX-LS: THE LAB'S LEGACY OF SCIENCE AND ENGINEERING ACHIEVEMENTS

For many years, Lab research focused on the development of particle accelerators, based on Lab founder E.O. Lawrence's cyclotron invention. Premier among these was the Bevatron, a machine 100 meters in diameter and capable of producing up to 6.5 billion volts of energy, which was located where the Open House is taking place. The Lab's retirees association will display a model of the Bevatron and share information on the Nobel Prize winning research conducted there. Learn about other historical achievements, including state-of-the-art electronics technology and large-scale facility design and construction, like the Keck telescope.



*Berkeley Lab science explorers
study microbial diversity in
volcanic regions in Siberia*

THE INVENTION CHALLENGE BY TECHNOLOGY TRANSFER AND INTELLECTUAL PROPERTY MANAGEMENT

Navigate the path Berkeley Lab inventions travel to reach the marketplace in a fun beanbag game. Toss beanbags to tag an invention, kick off the patent process, and learn how the technology can be licensed to benefit society and the U. S. economy. Your prize? A personalized patent certificate for the invention. Next, learn wacky patent facts. Answer questions using hints posted around the booth and you've won! Now you know more about how Tech Transfer helps commercialize inventions...except we don't really use beanbags.

BERKELEY LAB GUEST HOUSE

The Berkeley Lab Guest House provides accommodations on the hill for scientists, employees, visiting researchers and special guests of the Lab. They are also open to people visiting UC Berkeley, students and their parents. Visit the Berkeley Lab Guest House booth to learn more about this state of the art facility, its sustainable building features and to purchase t-shirts, travel cups and more. A limited number of Open House t-shirts will also be available for sale.

SHARE YOUR OPEN HOUSE PHOTOS

Share your open house photos with the world! Grab your smart phone or camera and capture your favorite moments at Berkeley Lab. Send your pictures to openhouse@lbl.gov with your name. Or tweet them with the hashtag #LBNLopenhouse. We'll collect your pictures as they come in and post them on a monitor next to the welcome booth. We'll also post your pictures on our various social media sites the following week.

ASK-A-SCIENTIST

Step right up and ask one of the Lab's world-class scientists questions about their research. Each researcher will be on hand for about a 1/2 hour.

Section: 3

HOW THE LEOPARD REALLY GOT HIS SPOTS

The basis for patterning in animals can be described using a simple set of coupled differential equations, which correspond to reaction and diffusion of chemicals. See demonstrations of chemical reactions and how the size of ions affects their diffusion. See coupled reaction/diffusion systems that produce chemical oscillations in time and space.

EXPLORE THE A-MAZE-ING COSMOS

What is dark matter? Where does the matter we are made of come from? What happened after the Big Bang? When and how did matter separate from antimatter? When did atoms form? Explore these fascinating subjects and others while finding your way through a MAZE of facts around cosmology. Just watch out for the black hole — we know where some of them are, but when you explore the universe, you never know what you'll find!

EXPLORING THE UNIVERSE AT THE SMALLEST AND LARGEST SCALES

Find out how Lab scientists use detectors all around the world like ATLAS at the Large Hadron Collider at CERN in Geneva (Switzerland), IceCube at the South Pole, or a telescope in New Mexico that's used for the Baryon Oscillation Spectroscopic Survey (BOSS) to understand how the smallest subatomic particles work as well as stars, galaxies and other things that make up our universe. See parts of the detector that found the Higgs particle as well as prototype modules of the most sophisticated gamma ray detector ever built for studies of the nuclei of atoms.



Berkeley Lab science explorers study neutrinos in the South Pole

SURFING ELECTRONS ON A LASER-PLASMA WAVE

Laser pulses lasting one quadrillionth of a second and with peak power of trillions of watts can be used to make waves in ionized gases (plasma waves). Similar to surfers on ocean waves, particles can be accelerated on plasma waves. How does it work and how can we generate trillion-watt pulses when the output power of the machine is equivalent to one of your light bulbs at home? Come and behold movies and demonstrations that will bring lasers, waves, and plasmas to life.

EXPLORING RADIOACTIVITY AND COSMIC RAYS

Radioactivity is everywhere. It is a natural part of our food and soil, and it also comes from the sun and outer space. We will demonstrate how scientists "see" these different types of radiation. Operate a Cosmic Ray detector, which measures stardust. Use a Geiger counter to see which items are radioactive. Operate our gamma detector, which is being used to measure the radioactive nuclides that arrived last year in the Bay Area from the earthquake in Japan and compare current results with those of the previous year.

Section: 4

KEEPING OUR SCIENCE EXPLORERS SAFE

Check out an Alameda County fire engine, Haz Mat response truck, emergency services trailer, and UC police department patrol car, while talking to fire fighters and police officers about their work. Learn about the wildlife that inhabits the hills around Berkeley Lab, and how we conduct environmental monitoring to keep our surroundings safe. Kids can don lab coats, safety glasses, and gloves to see how experiments are conducted safely. They can also measure decibels to determine safe levels of noise. At the "Fall-o-Ween" display, help "Rescue Randy" perform his work while suspended for a davit arm system in his safety harness. Try on a safety harness and have some fun taking souvenir photos. Conduct calculations to prevent Rescue Randy from falling.

FIRST AID IS LOCATED IN THIS SECTION



Section: 5

EXPLORE ENERGY! ENVIRONMENTAL ENERGY TECHNOLOGIES

Experience just how cool roofs and cool pavements can cool your home, your city, and our planet through a demonstration comparing cool and conventional products for roofs and pavements, and check out the cool pavement experiment right in the parking lot of the event. Watch electricity vampires in action by testing home appliances to see how much power they are using, when you thought they were off. Stop by the LIGTT booth to see how the Lab's research is being used to combat global poverty. Check out the Darfur stove, which has helped the women and environment of this war-torn region. Learn how scientists use tools like the infrared camera to study heat transfer and make buildings more energy efficient. Learn about energy conversion and storage technologies that could support production of electricity from renewable sources and lead to better electric vehicles.

Section: 6

EXPLORING THE WORLD OF NANOSCIENCE

Use our own treasure to experiment with how objects denser than water can float using surface tension and how we can disrupt it. Make your own Worm-Goo capsules and understand how nanoscientists create functional structures with a process called self-assembly, in which nanostructures actually assemble themselves. Learn how bird feathers, butterfly wings, shells, and beetle shells all have an iridescent effect by making your own thin films, and help build a giant, 15-foot tall nanotube using balloons.



Berkeley Lab science explorers & engineers developed an energy-efficient stove for use in Darfur, Africa

DIVE INTO BIOLOGY: EXPLORE HOW WORMS HELP UNDERSTAND CANCER AND AGING

Watch videos of a voyage in the Alvin submersible to retrieve *Alvinella pompejana* worms from black smoker chimney vents at the bottom of the Pacific Ocean. Examine protein crystals to see how genes from *Alvinella* are used to understand how cells protect against cancer. Look under a microscope to see living planaria worms isolated from rivers that are used to understand aging.

SCIENCE AT WARP SPEED: A JOURNEY THROUGH SPACE AND TIME IN 3D

Travel 14 billion years back to the beginning of space and time. Soar through burner flames and supernova explosions. Explore the microscopic pores of rocks buried deep inside Earth, or zip around the world at 100 gigabits per second. Sound impossible? Researchers go on this journey every day with the ultimate scientific instruments — supercomputers and networks. Part time-machine, spaceship, microscope and more, these tools allow humans to explore environments and events that are too big, too small, too fast, too slow, or too dangerous to study otherwise.



See map on back cover

DNA BIOPROSPECTORS AND BIOSCRIBERS: BLAZING PATHWAYS FROM NATURE TO NEW FUELS

Nature is a rich source of information that can be harnessed to improve our lives. While technology is now at hand to “read” the genetic code of all the organisms on Earth, the next frontier is in the “writing” of DNA, the design and construction of cellular systems that can help with applications such as rendering fuel from green plants to power our vehicles. Join the team of DNA Bioprospectors and Bioscribers as they first extract and test enzymes from mushrooms that can break down plants, then use these results to help design the cells that will yield the best fuel from the forest.

BIOSCIENCE = COOL SCIENCE

What if you could turn a cell phone into a microscope – and use it to diagnose disease in a remote jungle? What if you could charge your cell phone as you walk – with a bacterial film on the soles of your shoes? What if you could reconstruct the molecular structure inside crystal? What if you could create enough energy to power batteries, lights, and vehicles – using the sun and plants instead of fossil fuels? Physical Biosciences researchers ask “what if” and explore the frontiers of science to find the answers.

MAKE LIKE A LEAF: FINDING BETTER WAYS TO HARVEST THE SUN'S ENERGY BY MIMICKING PLANTS

Come find out how plants harvest energy using light from the sun, and learn why scientists are building a device that can do the same! “Artificial Photosynthesis” is one of the ways that we might solve the world’s energy problems. Discover more about solar energy science through fun games and displays, including model cars that run on solar power!



See map on back cover

PLANTS TO BIOFUELS: SCIENCE AT THE JOINT BIOENERGY INSTITUTE

Various non-food crop plants can provide the ideal renewable source for biofuel production. To reach this goal, researchers are focusing on understanding plant and biomass composition, deconstructing the plants to sugars, and developing microbes that can convert the sugars to fuels. Learn how this conversion takes place.

ALASKA, AUSTRALIA, AFRICA AND BEYOND: EXPLORING THE WORLD AROUND US

Securing our energy future in an environmentally responsible way, the scientists in the Earth Sciences Division perform research to tackle some of the planet’s most pressing issues related to climate change, carbon capture and storage, environmental remediation, energy resources, improved oil recovery, and nuclear waste disposal.



Berkeley Lab science explorers conduct research on climate change and ecosystems in Alaska

TECHNOLOGY ENGINEERED TO ENHANCE SCIENCE

The Engineering Division brings together technicians, machinists and engineers to develop technology and instruments that assist our scientific programs in their endeavor to understand the energy challenges.

Section: 7

FAMILY ADVENTURE ZONE

BUBBLE FESTIVAL

Have you ever been inside a bubble? Step inside our special "body bubble" to discover the world through a soapy, watery wall! Investigate the surprising properties and patterns of bubbles, uncover the sparkling realm of bubble shapes, and explore surface tension with string, straws, and soap!

MICROSCOPIC EXPLORATIONS

Be a microscopic explorer and discover the world of the small! Make a water drop magnifier and use hand lenses and microscopes to explore the up-close worlds of sand, minerals, fingerprints, pond life, and more! These hands-on activities are sure to ignite your curiosity about the hidden beauty of everyday things.

Section: 8

FACILITIES DIVISION: BASE CAMP FOR SCIENTIFIC EXPLORATION

Tour the Facilities Pavilion to learn about their past, present and future, see how the Lab's crafts-people make things work, check out the live goats the Lab uses to manage vegetation and reduce fire hazards, learn how the Lab conserves resources to go green, look at the vehicles large and small that help get work done at the Lab, cheer for your favorite machine at a student robot competition, and enjoy games and activities for all ages.

Section: 9

ADVENTURE CAFÉ

Choose from a variety of tasty lunch items and beverages for purchase then sit with your family and friends and relax under the dining tent. Snack selections also include kettle corn, smoothies, ice cream and churros.

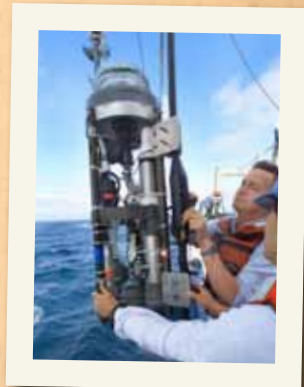
SUSTAINABILITY: EXPLORING WAYS TO REDUCE THE LAB'S ENVIRONMENTAL IMPACT

Learn how the Lab is working to meet aggressive sustainability goals that minimize waste and reduce the impact of its operations.

Berkeley Lab is working to build more efficient buildings, retrofit existing buildings with more efficient equipment, reduce energy and water use, eliminate waste, purchase environmentally friendly products, engage employees, and deploy new technologies to become a leader

in sustainability.

Berkeley Lab science explorers study the ocean's absorption of CO₂ in the Pacific Ocean



Section: 10

LECTURES

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| 10:30 am | Manfred Auer — <i>A 3-D Peek Into the Inner Workings of Cells</i> |
| 11:00 am | Nathan Hillson — <i>Synthetic Biology: What it Is and How it's Useful</i> |
| Noon | Saul Perlmutter — <i>The Nobel Prize One Year Later</i> |
| 12:30 pm | Paul Alivisatos (Berkeley Lab Director) — <i>Climate Change: What We Need to Know and What We Need to Do</i> |
| 1:30 pm | Ian Hinchliffe — <i>Latest News on the Higgs Boson From the Large Hadron Collider</i> |
| 2:00 pm | Blake Simmons — <i>Driving the Bioeconomy: Advanced Biofuels at Joint BioEnergy Institute</i> |
| 2:30 pm | Peter Denes — <i>A Next Generation Light Source</i> |

BUS STOP - LAB TOUR

TICKETS REQUIRED

Pick-up in Section: 2

See page one of program for more information

2012
BERKELEY LAB
OPEN HOUSE

-  Welcome Booth/Information
 First Aid  Elevated Area
 Restrooms  Stairs
 Downtown Shuttle

